

**WHAT IS CLAIMED IS:**

1        1. A multi-sector in-building repeater in communication with a base station, the  
2        multi-sector in-building repeater comprising:

3                a master transmitting unit for receiving multi-sector signals of a carrier frequency from the  
4        base station, mixing the multi-sector signals with different transmission intermediate frequency  
5        signals, and outputting mixed multi-sector signals to a same transmission line;

6                a plurality of slave transmitting units for extracting sector signals assigned to the  
7        multi-sector signals from the master transmitting unit, converting extracted sector signals into high  
8        frequency signals, and transmitting converted high frequency signals through an antenna;

9                a plurality of slave receiving units for mixing different receiving intermediate frequency  
10      signals with the sector signals of carrier frequencies from the antenna, converting mixed signals  
11      into multi-sector signals of different receiving intermediate frequency bands, and outputting  
12      converted sector signals to a same transmission line;

13                a master receiving unit for mixing multi-sector signals at the plurality of slave receiving  
14      units, the multi-sector signals having been transmitted through the same transmission line from  
15      the plurality of slave receiving units and converted into different receiving intermediate frequency  
16      band signals, with different intermediate frequency band signals, separating each of the sector  
17      signals, converting separated sector signals into receiving carrier frequency signals, and outputting  
18      converted signals to the base station;

19                a master transmitting/receiving separator for separating transmitted/received signals of the

20 master transmitting unit from transmitted/received signals of the master receiving unit; and  
21 a distributor for distributing received multi-sector signals from the master transmitting unit  
22 to the plurality of slave receiving units, receiving sector signals being converted into receiving  
23 intermediate frequency band signals from the plurality of slave receiving units, and transmitting  
24 converted sector signals to the master receiving unit.

1 2. The repeater according to claim 1, wherein the master transmitting unit comprises:

2 a plurality of mixing units for receiving assigned carrier frequency sector signals from the  
3 base station, mixing received sector signals with different transmission intermediate frequency  
4 signals, and outputting mixed sector signals; and

5 a plurality of amplifying units for filtering off unnecessary signals output signals of the  
6 mixing units, the sector signals having been converted into different transmission intermediate  
7 frequency signals, for amplifying the sector signals without the unnecessary signals to a  
8 predetermined level, and for outputting amplified signals to a same transmission line.

1 3. The repeater according to claim 2, wherein each of the mixing units comprises:

2 an attenuator for receiving high frequency sector signals of an assigned carrier frequency  
3 from the base station, attenuating received high frequency sector signals, and outputting attenuated  
4 high frequency sector signals; and

5 a mixer for mixing the attenuated carrier frequency sector signals at the attenuator with  
6 signals having subtracted different transmission intermediate frequency band signals from the

7 carrier frequency, and outputting converted sector signals into the different transmission  
8 intermediate frequency band signals to each of the amplifying units.

1 4. The repeater according to claim 2, wherein each of the amplifying unit comprises:

2 a band-pass filter for filtering off converted sector signals into different transmission

3 intermediate frequency band signals provided from the mixing units; and

4 an amplifier for amplifying filtered sector signals through the band-pass filter to a

5 predetermined level, and outputting amplified sector signals to a transmission line.

1 5. The repeater according to claim 1, wherein the slave transmitting unit comprises:

2 a sector signal extracting unit for receiving the converted multi-sector signals into different

3 transmission intermediate frequency signals provided from the master transmitting unit, mixing

4 sector signals to be extracted out of the received multi-sector signals with signals having

5 subtracted a predetermined value from the transmission intermediate frequency signals, and

6 extracting sector signals; and

7 a high frequency signal generating unit for converting extracted sector signals at the sector

8 signal extracting unit into high frequency signals, and transmitting converted signals through an

9 antenna.

1 6. The repeater according to claim 5, wherein the sector signal extracting unit comprises:

2 a first band-pass filter for filtering off multi-sector signals having been converted to

3 different transmission intermediate frequency signals provided from the master transmitting unit;  
4 a mixer for receiving filtered multi-sector signals from the first band-pass filter, mixing  
5 sector signals to be extracted out of the multi-sector signals with signals having subtracted a  
6 predetermined value from mixed transmission intermediate frequency signals, and outputting  
7 mixed signals; and  
8 a second band-pass filter for filtering off output signals of the mixer, and extracting a  
9 desired sector signal.

1 7. The repeater according to claim 5, wherein the high frequency signal generating unit  
2 comprises:

3 a high frequency generator for generating high frequency signals by mixing sector signals  
4 extracted through the sector signal extracting unit with signals having subtracted a predetermined  
5 value from the base station carrier frequency; and  
6 a power amplifier for amplifying power of the high frequency signals provided by the high  
7 frequency generator, and transmitting amplified signals through an antenna.

1 8. The repeater according to claim 1, wherein the slave receiving unit comprises:

2 an intermediate frequency generating unit for generating intermediate frequency signals by  
3 mixing receive carrier frequency sector signals provided through the antenna with assigned receive  
4 intermediate frequency signals; and  
5 an amplifier for filtering off intermediate frequency signals generated by the intermediate.

6 frequency generating unit, and amplifying filtered intermediate frequency signals to a  
7 predetermined level.

1 9. The repeater according to claim 8, wherein the intermediate frequency generating unit  
2 comprises:

3 an amplifier for amplifying receive carrier frequency sector signals provided through the  
4 antenna to a predetermined level;

5 a band-pass filter for filtering the receive carrier frequency sector signals being amplified  
6 by the amplifier; and

7 a mixer for mixing filtered receive carrier frequency sector signals provided from the  
8 band-pass filter with signals having subtracted intermediate frequency signals from a receive  
9 carrier frequency.

1 10. The repeater according to claim 8, wherein the amplifying unit comprises:

2 an amplifier for amplifying intermediate frequency band sector signals provided by the  
3 intermediate frequency generating unit to a predetermined level; and

4 a band-pass filter for filtering off amplified intermediate frequency band sector signals from  
5 the amplifier, and transmitting filtered signals to the master receiving unit.

1 11. The repeater according to claim 1, wherein the master receiving unit comprises:

2 a plurality of sector signal separating units for receiving converted multi-sector signals into

3 different receive intermediate frequency band signals provided from the plurality of slave receiving  
4 units, mixing sector signals to be extracted with signals having subtracted a predetermined value  
5 from mixed receive intermediate frequency signals, and separating the sector signals to be  
6 extracted; and

7 a plurality of high frequency generating units for receiving separated sector signals from  
8 the sector signal separating unit, mixing the separated sector signals with signals having subtracted  
9 a predetermined value from a receive carrier frequency, converting receive intermediate frequency  
10 band signals to receive carrier frequency band signals, and outputting converted signals to the base.  
11 station.

1 12. The repeater according to claim 11, wherein the sector signal separating unit  
2 comprises:

3 a mixer for receiving converted multi-sector signals into different receive intermediate  
4 frequency band signals provided from the plurality of slave receiving units, for mixing sector  
5 signals to be extracted with signals having subtracted a predetermined value from mixed receive  
6 intermediate frequency signals, and outputting mixed signals; and

7 a band-pass filter for receiving the mixed signals from the mixer, performing band-pass  
8 filtering around the predetermined value, and separating the sector signals to be extracted.

1 13. The repeater according to claim 11, wherein the high frequency generating unit  
2 comprises:

3           a mixer for receiving separated sector signals from the sector signal separating unit, mixing  
4       the sector signals with frequency signals having subtracted a predetermined value from a receive  
5       carrier frequency, converting receive intermediate frequency band signals to receive carrier  
6       frequency band signals, and outputting converted signals; and  
7           an amplifier for amplifying the receive carrier frequency band signals output from the  
8       mixer to a predetermined level.

1           14. Apparatus for transmitting sector signal in multi-sector in-building repeater, the  
2       apparatus comprising:

3           a master transmitting unit for receiving multi-sector signals of a carrier frequency from the  
4       base station, mixing the multi-sector signals with different transmission intermediate frequency  
5       signals, and outputting mixed multi-sector signals to a same transmission line;  
6           a plurality of slave transmitting units for extracting sector signals assigned to the  
7       multi-sector signals from the master transmitting unit, converting extracted sector signals into high  
8       frequency signals, and transmitting converted high frequency signals through an antenna.

1           15. The apparatus according to claim 14, wherein the master transmitting unit comprises:

2           a plurality of mixing units for receiving assigned carrier frequency sector signals from the  
3       base station, mixing received sector signals with different transmission intermediate frequency  
4       signals, and outputting mixed sector signals; and  
5           a plurality of amplifying units for filtering off unnecessary signals output signals of the

6 mixing units, the sector signals having been converted into different transmission intermediate  
7 frequency signals, for amplifying the sector signals without the unnecessary signals to a  
8 predetermined level, and for outputting amplified signals to a same transmission line.

1 16. The apparatus according to claim 15, wherein each of the mixing units comprises:

2 an attenuator for receiving high frequency sector signals of an assigned carrier frequency  
3 from the base station, attenuating received high frequency sector signals, and outputting attenuated  
4 high frequency sector signals; and

5 a mixer for mixing the attenuated carrier frequency sector signals at the attenuator with  
6 signals having subtracted different transmission intermediate frequency band signals from the  
7 carrier frequency, and outputting converted sector signals into the different transmission  
8 intermediate frequency band signals to each of the amplifying units.

1 17. Apparatus for receiving sector signal in multi-sector in-building repeater, the apparatus.

2 comprising:

3 a plurality of slave receiving units for mixing different receiving intermediate frequency  
4 signals with the sector signals of carrier frequencies from the antenna, converting mixed signals  
5 into multi-sector signals of different receiving intermediate frequency bands, and outputting  
6 converted sector signals to a same transmission line;

7 a master receiving unit for mixing multi-sector signals at the plurality of slave receiving  
8 units, the multi-sector signals having been transmitted through the same transmission line from

9 the plurality of slave receiving units and converted into different receiving intermediate frequency  
10 band signals, with different intermediate frequency band signals, separating each of the sector  
11 signals, converting separated sector signals into receiving carrier frequency signals, and outputting  
12 converted signals to the base station;

13 a distributor for distributing received multi-sector signals to the plurality of slave receiving  
14 units, receiving sector signals being converted into receiving intermediate frequency band signals  
15 from the plurality of slave receiving units, and transmitting converted sector signals to the master  
16 receiving unit.

1 18. The apparatus according to claim 17, wherein the slave receiving unit comprises:

2 an intermediate frequency generating unit for generating intermediate frequency signals by  
3 mixing receive carrier frequency sector signals provided through the antenna with assigned receive  
4 intermediate frequency signals; and

5 an amplifier for filtering off intermediate frequency signals generated by the intermediate  
6 frequency generating unit, and amplifying filtered intermediate frequency signals to a  
7 predetermined level.

1 19. The apparatus according to claim 18, wherein the intermediate frequency generating  
2 unit comprises:

3 an amplifier for amplifying receive carrier frequency sector signals provided through the  
4 antenna to a predetermined level;

5           a band-pass filter for filtering the receive carrier frequency sector signals being amplified  
6        by the amplifier; and  
7           a mixer for mixing filtered receive carrier frequency sector signals provided from the  
8        band-pass filter with signals having subtracted intermediate frequency signals from a receive  
9        carrier frequency.

1           20. A method of providing signals from a base station to multiple sectors in a building  
2        utilizing a multi-sector in-building repeater, comprising:

3           attenuating and amplifying a plurality of sector signals of a carrier frequency received from  
4        the base station;

5           mixing each of the attenuated and amplified sector signals with corresponding different  
6        transmission intermediate frequency signals, and outputting each of the mixed sector signals to a  
7        same transmission line via a first duplexer;

8           distributing the mixed sector signals of the same transmission line to a plurality of slave  
9        transmitting units disposed at respective ones of the multiple sectors;

10           extracting sector signals in each of the multiple sectors by utilizing different intermediate  
11        frequency signals assigned to respective ones of the slave transmitting units;

12           converting the extracted sector signals into high frequency signals, and transmitting the  
13        converted high frequency signals via a second duplexer through respective antennas, disposed  
14        within each of the multiple sectors.

1           21. The method as set forth in claim 14, further comprising:

2           generating, in each of a plurality of slave receiving units, intermediate frequency signals

3           by mixing receive carrier frequency sector signals provided through the antenna and the second

4           duplexer, with assigned receive intermediate frequency signals;

5           outputting the intermediate frequency signals of each slave receiving unit to said first

6           duplexer via said same transmission line;

7           converting the intermediate frequency signals of each slave receiving unit, output by the

8           first duplexer, to different carrier frequency signals for transmission to said base station.